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Project name:
Portland Harbor Superfund Site
Pre-Remedial Design
Investigation Studies

Project ref:
Response to Additional EPA Comments on PDI Sediment Trap Design

To: Davis Zhen, USEPA Region 10

From:
Pre-RD AOC Group

Date:
April 3, 2018

Memo

The U.S. Environmental Protection Agency (EPA) passed comments from Dale Norton of the Washington Department of Ecology (Ecology) regarding sediment trap design to the Pre-RD AOC Group on March 23, 2018 (see Attachment 1). The sediment trap design for Pre-Remedial Investigation and Baseline Sampling Studies (PDI) in 2018 was presented in the draft Surface Water and Sediment Trap Field Sampling Plan and is consistent with the methods successfully used during the Remedial Investigation/ Feasibility Study (RI/FS) (see Attachment 2 summary). This design sufficiently addresses the goals of the PDI, including the primary goal of collecting adequate volume of settled particulate matter (SPM) for chemical analysis, especially since EPA may collect split samples. We strongly believe this design is ideal for our PDI studies.

In response to Ecology comments regarding sediment trap design:

1. Overall Trap Design: The dimensions, ratio, and cluster design are all consistent with the methods used during the previous Round 3A RI events (Attachment 2). The ASAOC Work Plan states that we would follow RI methods as much as possible, and comparability to previous data is important. In addition, this trap design has been used successfully at numerous sediment EPA Superfund sites in the Pacific Northwest, including Whatcom Waterway, Eagle Harbor, Duwamish River, Portland Harbor, Lake Union/Gas Works Park, and Harbor Island Waterway.
2. Trap Diameter: Larger 6-inch-diameter tubes have better trapping efficiency.
    a. The 6-inch-diameter tubes were successfully used during the Round 3 RI/FS sampling event. During summer low flow, analytical testing for specific analytes had to be prioritized because of limited volume at some stations. For this reason, we did not select smaller diameter tubes.
    b. If we use the data to estimate sediment loading, then potential bias of trap design would be considered in the analysis. We can work with EPA and hydrodynamic modelers that know the Willamette River system on how to best calculate flux rates at a later date.
3. Trap Ratio: From our experience, the 5:1 ratio is also important to keep the sediment inside the tube. If the trap is not deep enough, fish can swim around inside the cylinder then swim back out and entrain sediment with it.
4. A Clustered Array is much preferred for several reasons:
    a. Stability and anchoring, especially with large river flows (> 50,000 cubic feet per second) like the Willamette.

b. Protection of the glass tubes from floating debris is better with a circular supporting structure; this support structure has been further enhanced for the PDI study.
c. Ease of deployment and retrieval.
d. Comparability with previous data.
e. Our hydrodynamic modelers that know the river do not think linear vs. cluster array is a critical factor. Also, each trap will have 4 discrete measurements of SPM, one per tube, and 12 measurements (4*3) across a river section, which will help evaluate variability.

5. Salinity Gradient: We agree that adding saline water to the cylinder is a good idea, and it will be included in our protocol.

ATTACHMENT 1 - Additional EPA Comments on Trap Design

From: Zhen, Davis [mailto:Zhen.Davis@epa.gov]
Sent: Friday, March 23, 2018 10:57 AM
To: Tyrrell, Ken <ken.tyrrell@aecom.com>
Subject: ATTENTION: Additional comments on sediment trap

Hi Ken,
We reached out to Dale Norton for his comments on the sediment trap design. He has pointed out some issues with the current design. Please see below.

Comments on the sediment trap design.

- The height to width ratio of 5 to 1 came from flume experiments and Reynolds number calculations. We used 4" diameter cylinders in our studies to be representative of average currents in Puget Sound. 6" is quite a bit larger. It only matters if you want to calculate a flux rate. Too wide and the traps over collect, too narrow and they under collect. If you just want to capture particulates for analysis it does not really matter. I can send some supporting articles if you need them.
- I don't think it is as simple as just maintaining the right ratio. The width is the critical component.
- Concerning a circular array I am sure it will collect material however the basic concept is that there is laminar flow across the mouth of the cylinder. Turbulence is created as the water flows over the cylinder causing it to slow down and lose suspended sediments. Given that we have always tried to make sure that each cylinder is unobstructed in the flow. I would be concerned about shadowing of some of the cylinders depending on the direction of flow. They might consider just putting them in a line instead of a circle to avoid this issue.
- We typically added about 1 liter of high salinity water to each cylinder to create a density gradient to trap particulates. It is also a way of checking to make sure the cylinder has remained upright during deployment (check the salinity of the water)

Here are the results from monitoring work we did in Commencement Bay that explains some of this information.
https://fortress.wa.gov/ecy/publications/documents/96315.pdf

Dale Norton | Western Operations Section Manager | Environmental Assessment Program | WA Dept. of Ecology | work 360-407-6596 cell 360-522-0159| Dale.Norton@ecy.wa.gov

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Thanks,

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ATTACHMENT 2
Summary of Portland Harbor RI/FS Quarterly Reports Related to Sediment Trap Sampling
Prepared by AGF on 3/31/2018 for Pre-RD AOC Group

LWG Field Sampling Plan Sediment Traps, March 2006 (Anchor 2006)

The specific objectives of the Round 3 sediment trap sampling program were to collect sediment trap mass and chemical concentration data to further characterize the nature and extent of waterborne sediment contamination that enters the Study Area from upstream sources, is associated with regional sources within the Study Area, and exits the downstream end of the Study Area. FSP also stated that data will also support better understanding of potential recontamination and/or natural recovery potential of bedded sediments, and inform a characterization of background conditions. These chemical concentrations can help establish chemical concentrations below which bedded sediments cannot be remediated through actions taken entirely within the study area. Sediment traps were placed at 12 locations including two upstream stations at about RM 11 and RM 16 (two each). Sediment traps were deployed by diver for one year and recovered quarterly for metals, SVOCs, PCBs, TPH, dioxins/furans, pesticides/herbicides, hexavalent chromium, grain size, total solids, TOC, and specific gravity.

On the layout, the FSP states that traps are designed in a clustered array consisting of 4 glass tubes inside protective PVC sleeves with a central mounting frame. The sleeves will be fastened together and will include hardware for mounting and securing on a rebar post driven into the river bottom. This array design has been confirmed by Gravity, who did much of the work (same contractor that we are using). Each tube will be approximately 10 cm (6 in) diameter and 55 cm long (stated in the FSP) but all the field forms recorded 15 cm tube diameter (screen shot below).[1] The top of the tube was at 3 ft above mudline and secured with rebar rods to the sediment bottom with a grapple anchor line for retrieval. There was no mention of sodium azide or saline water used during trap deployment.

Overall, the traps were successfully deployed and retrieved. Table 1 presents the average amount of settling particulate matter (SPM) accumulated at each station over the four sampling quarters. Sediment traps ST007 and ST008 were located near RM 11.8. Sediment traps ST009 and ST010 were located near RM 15.8. Field report summaries are included below.

LWG Round 3A Sediment Trap Sampling Q1 Field Report January 2007 (Anchor, April 2007)

Traps were deployed Oct 30, 2006, and the first quarterly retrieval event was Jan 30, 2007. At 3 of 16 locations, the trap was not found (ST006, ST014, ST016); assumed to have been dislodged by vessel propwash or large floating debris moving along the bottom of the river. Placement locations of missing traps were moved to more quiescent environments for redeployment. Existing traps were easily found with the grapple hooks. Divers noted tree stumps, logs, and other vegetative debris accumulated against the trap at ST016. All retrieved sediment traps had adequate sediment for all targeted analyses listed in the FSP. It looks like ST007 for example, had one tube with a baffle and another without. The accumulated sediment was about the same for the two measurements, indicating that baffles were not necessary.

LWG Round 3A Sediment Trap Sampling Q2 Field Report July 2007 (Anchor, July 2007)

The second quarterly event occurred late April to May 2007 for deployment, and traps were retrieved in July 2007. There was no mention of missing traps; however, a few traps had insufficient volume for full suite of analytical testing, including ST010. Sediment accumulation for the low flow summer and early fall events was much lower than the winter event.

LWG Round 3A Sediment Trap Sampling Q3 Field Report October 2007 (Anchor, Oct 2007)

The third quarterly event occurred in August 2007 for deployment, and traps were retrieved in late October 2007. The traps were readily found with the grapple hooks, and there was no mention of missing traps. Five traps had insufficient sediment for collection (include ST008 and ST010) and those traps were returned to the bottom for continued collection. The volume of sediment collected from four locations (including ST009) was insufficient to

[1] We have constructed 15 cm diameter tubes for the PDI study, consistent with the RI.

fill the full set of sample jars (to be confirmed by the lab). Field notes say that traps were not redeployed with the baffles, because it was difficult to adequately clean the baffles and/or field crews wanted to encourage fish inside tubes to swim free.

LWG Round 3A Sediment Trap Sampling Q4 Field Report January 2008 (Anchor, Jan2008)

The fourth quarterly event occurred in late October 2007 for deployment, and traps were retrieved January 2008. There was no mention of missing traps. The volume of sediment from 3 locations, including ST009, was insufficient to fill the full set of sample jars (confirmed by the lab).

Table 1. Summary of Sediment Accumulated in Round 3A Sediment Traps at RM 11 and RM 16

Trap # (1)	Average Sediment Height (cm) in Glass Tubes (4)				SPM Material Description (4 events)
	Jan 2007 (6)	July 2007	Oct 2007	Jan 2008	
ST007	37	10.0	7.1	7.9	Gray silty sand; gray silty sand; gray silt; silty sand
ST008	69 (5)	16.0	2.9 (3)	12.5	Organic litter; mostly woody debris; light gray silt; grayish green silt
ST009	6.3	10.7	4.9 (2)	1.7 (2)	Organic litter with gray silt; brownish silt with significant grass litter; light gray silt; gray silt
ST010	52	9.7 (2)	1.4 (3)	6.0	Brownish gray sandy silt; light gray silt; grayish brown silt

Notes:

(1) Sediment Traps ST007 and ST008 are located near RM 11.8. Sediment traps ST009 and ST010 are located near RM 16.0.
(2) Insufficient volume to fill all sample jars for testing.
(3) Insufficient volume, traps redeployed without sample collection.
(4) Individual tube measurements were generally within +/- 2 cm from each other.
(5) Tube glass tube height at ST008 during Jan 2007 event was about 78 cm tall.
(6) Individual tube measurements in the Q1 Jan 2007 event compared baffle/no baffle design; results were less than 1 to 2 cm difference at 3 of 4 locations: ST007 (37.3, 37.4); ST008 (70.1, 68.0); ST009 (6.5, 6.1) and ST010 (49.1, 55.5).

SPM = settled particulate matter

ANCHOR ENVIRONMENTAL, L.L.C. Sediment Trap Collection Form

Date: 8/16/07 **Time:** 1200 **Deployment Duration (days):** 107

Weather:

Station ID: ST002 **Sample ID:** LWG-ST3002

Project Name: LWG Sediment Traps **Project Number:** 010142-01

Coordinates (NAD 83):
Lat/Northing: 726356 Long/Easting: 7616862
Oregon State Plane Feet

(A) Measured Water Depth (ft): 27 (diver gauge)

(B) Predicted Tide Height (ft) (MLLW): 1.4

(C) Predicted Mudline Elevation (ft) (MLLW): -25.6

(-A+B = C include sign of tide height as reported)

		Tube 1 (35)		Tube 2 (34)
Diameter (cm):		15		15
Sediment Height (cm): (8 perimeter measurements)	1	5.9		4.0
	2	7.0		3.8
	3	6.8		4.3
	4	5.0		5.7
	5	4.7		7.8
	6	~~8~~ 7.8 2.7		8.3
	7	2.8		6.7
	8	4.0		5.0
Average Sediment Height (cm):		4.9	5.3	5.7
Volume (L) = 0.177 x H:		0.9	1.0	1.0
			(1.9)	

Notes: Tape @ mudline.

Recorded by: DM